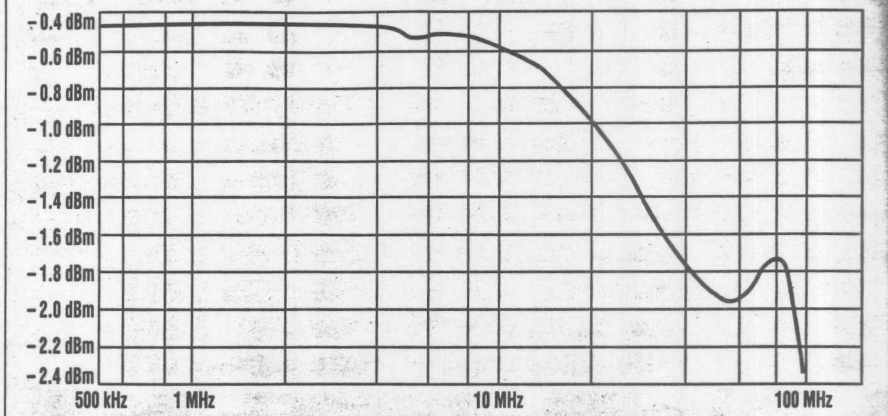
to 9.2 V. Consequently, the amplified luminance and chroma signals are restricted from running into the supply rails.

The gain for this circuit (and layout) is flat to within ±0.2 dB from 500 kHz to 13 MHz for a unity gain *(Fig. 2)*. The 3-dB point for this circuit (and layout) is 112 MHz. A comparison between the input and output signals of a burst of chroma information revealed virtually no loss of signal fidelity. An input/output comparison of a stepped luminance signal also indicated no fidelity loss. The amplifiers in this circuit draw only 4.6 mA each, making the device an excellent low-power video-distribution amplifier solution.



2. The unity-gain amplifier's gain is flat to within ±0.2 dB from 500 kHz to 13 MHz.

4-To-20-mA Loop Powers Temperature Sensor

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Using an analog temperature sensor, an op amp, a transistor, and a low-dropout linear regulator, this circuit provides a 4-to-20-mA output over a 3.75- to 28-V compliance range *(see the figure)*. Because the devices used maintain a low quiescent current, they can be powered by the loop with a slight offset error being the only consequence.

The temperature sensor IC1 feeds the op-amp/transistor combination, A1 and Q1, with R1 acting as the load on the amplifier. The temperature sensor's output characteristic is described by an offset of 744 mV at 0°C and a scale factor of 11.9 mV/°C.

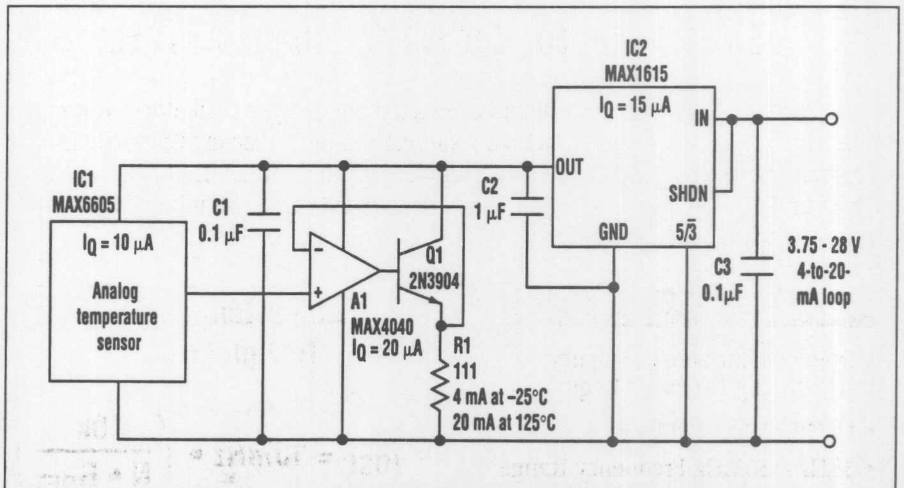
R1 is selected to achieve the best possible fit between IC1's temperature range and the 4-to-20-mA output. In this example, IC1's output at −25°C is 0.4465 V. Also, a 111-Ω resistor for R1 will supply a 4-mA output at −25°C. At 125°C, IC1's output is 2.213 V, yielding a 19.937-mA output with the 111-Ω resistor previously selected for R1. This current is reflected at the input of the low-dropout linear regulator IC2.

IC2 regulates the voltage to the sensor and op-amp circuit. Also, at the input voltage, it supplies the compliance necessary for connection to the 4-to-20-mA loop. Another feature of IC2 is that it's pin-programmable to generate either a 3- or 5-V output. In this circuit, IC1 and A1 operate at 3 V. This maximizes the input compliance by permitting input voltages as low as 3.75 V. This also results in a slight reduction of quiescent current of IC1 and A1, decreasing the error related to their quiescent currents.

The quiescent currents of all components combine and add to the 4-mA output that corresponds to negative full-scale. Consider this 45-μA current in light of the output-current scale factor, which is proportional to:

$$\frac{119\ \text{mV/°C}}{\text{R1}}$$

This yields a current of 106.66 μA/°C. The 45-μA quiescent current represents an offset of approximately 0.43°C. Since the current is an offset, it's possible to compensate for it elsewhere (such as in software, when the temperature data is digitized).



Using low-quiescent-current devices, this temperature sensor derives its power directly from the 4-to-20-mA current loop. This results in a slight offset error that can be compensated out.